ENERGY ENGINEERING ANALYSIS PROGRAM
ANNISTON ARMY DEPOT
ENERGY SURVEY OF
INDUSTRIAL FACILITIES (IND)
EXECUTIVE SUMMARY

PREPARED FOR:
U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT

PREPARED BY:
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
6725 ODYSSEY DRIVE
HUNSTVILLE, ALABAMA 35806

NOVEMBER 1988

DEPARTMENT OF THE ARMY
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EXECUTIVE SUMMARY

This report presents the results of the Army Industrial Facility Energy Survey of the Army Tank Rebuild Area at Anniston Army Depot (AAD). This project is being performed by Science Applications International Corporation (SAIC) under Contract No. DACA01-83-C-00099. The report includes an analyses of energy use within the industrial area, and supplies the identification and evaluation of energy conservation opportunities. The results obtained from the recommended projects indicate that the energy use of the manufacturing area could be reduced by 25 percent. Such savings assume that there will be no change in the level of production as well as no change in the production hours.

Anniston Army Depot is commonly known as the "Tank rebuild center of the free world" and ranks among the largest US ammunition storage facilities. It is a part of the Army's Depot System Command (DESCOM), which is a major subordinate command of the US Army Materiel Development and Readiness Command (DARCOM).

Anniston Army Depot is located in northeast Alabama, approximately ten (10) miles from the city of Anniston and Fort McClellan, another active US Army installation. The small community of Bynum lies on the depot's southern boundary with the remaining three boundaries only sparsely settled. The north boundary is Pelham Range, a wooded operational and training area owned by Fort McClellan. The east and west boundaries are bordered by lightly populated rural lands. A short distance to the south, Interstate 20, a major east-west artery, provides highspeed access to two of the south's largest cities, Birmingham, AL (50 miles west) and Atlanta, GA (110 miles east). Other geographical details are shown in the vicinity map in Figure 3.

There are 15,246 acres in the main depot with a separate inactive ammunition storage area known as the Coosa River Storage Annex. This 2,834-acre site, is located approximately 12 miles southwest of the main reservation on Talladega County Highway 93.

The total depot covers over 25 square miles of land with more than 18,000 acres of woodland and 40 acres of lakes and streams. There are almost 2,000 buildings and structures with 8.5 million square feet of floor space, approximately 250 miles of roads and streets, and 46 miles of railroad tracks.

The industrialized operations are located in the eastern portion of the depot with supply and administration in the western section. Ammunition storage and renovation occurs in the central, controlled access area of the depot.

Initial data for the study was gathered through a series of field visits to the various buildings engaged in tank rebuilding activities. During these visits, the patterns of energy use were identified, and the energy using characteristics of the processes and the building systems were evaluated. Finally, the potential for energy saving projects was analyzed. Energy use was identified by the use of metering where recorders could be easily installed. In other cases, this was done by estimating the energy use based on spot measurements or observations of the operation of the energy using systems. The result of this activity was the identification of the functional and building energy use of the tank rebuild facilities. Figures 1 and 2 show the historical annual energy use at AAD. Table 1 provides the estimated annual energy use by function in the industrial area.

To assist in the identification of viable energy conservation projects, a list of potential buildings was given to SAIC for evaluation during the field survey. All of the buildings listed are located in the industrial (east) area of the Depot. The buildings surveyed and their respective missions are listed below:

BLDG NO.	MISSION
108	Machine shop
114	Metal plating shop
117	Welding shop
128	Support shop
129	Warehouse/machine shop
130	Machine shop/drying facility
143	Turret rebuild shop
147	Machine shop
400	Tank body repair
409	Sand blast facility
410	Engine test facility
413	Burn and shear shop
421	Tool room/shear shop
433	Painting/sand blasting facility
434	Parts assembly and burn-off

The primary energy sources in the industrial area of AAD are electricity and coal. Electricity enters AAD at one principal location and only the total use is metered. Electricity use for the industrial area was estimated to be 51% of the

ANNISTON ARMY DEPOT

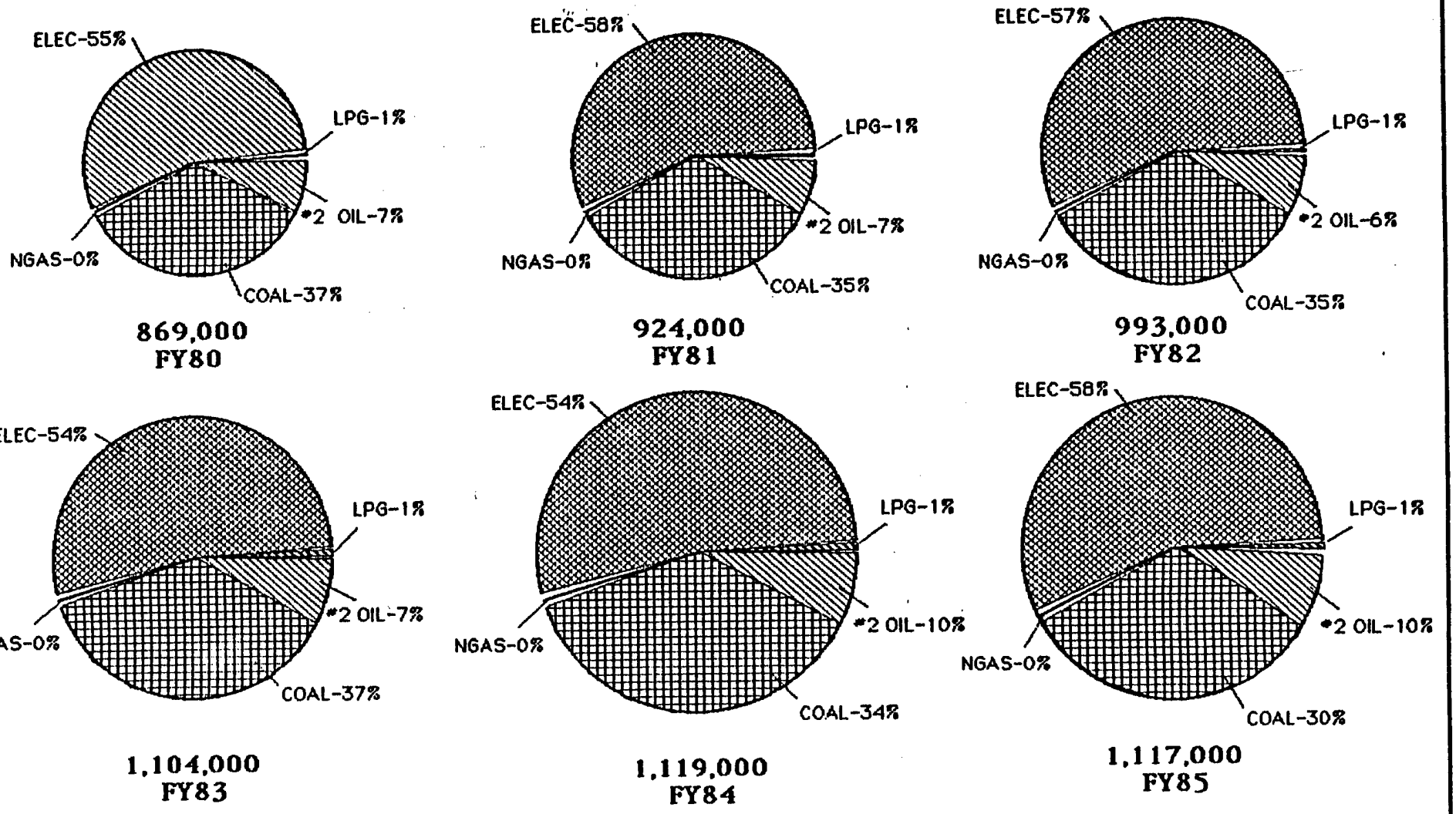


FIGURE 1 HISTORICAL Annual Fuel Consumption: Facility (MBTU)

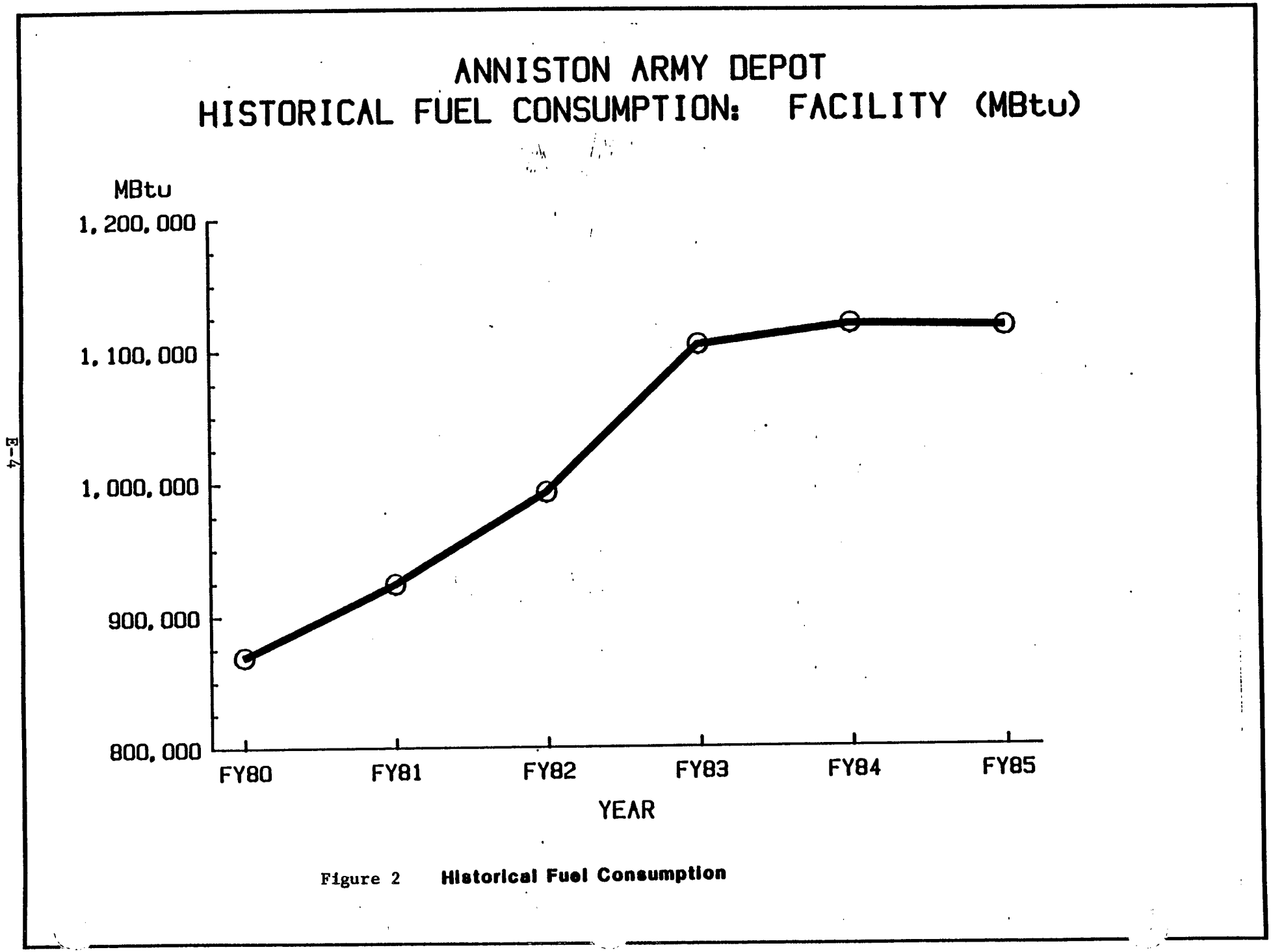


Figure 2 **Historical Fuel Consumption**

Table 1 ENERGY USE TABULATION
FOR THE INDUSTRIAL AREA

	MBtu/yr
ELECTRICAL:	
Lighting	37,404
Environmental Motors	22,664
Process Motors	82,904
Welding	3,907
Dynamometers	41,050
Air Compressors	46,500
Misc. Buildings	37,974
STEAM:	
Process -	
Spray Booths	4,222.2
Dryers	8,350.0
Steam Cleaning	4,776.0
Vats	25,143.0
Environmental -	
Heating	74,486
Ventilation	39,402
Power Plant	
Turbines/DA	14,503
Make-Up Losses	25,418
Insulation	29,010
Trap Losses	29,657
TOTAL	527,370

total AAD use. This value was determined by the use of instantaneous readings as well as temporary meter readings on several of the industrial buildings. Coal is used to generate steam that is used in processes, cleaning operations and building heating. The total estimated energy use of the industrial area is 527 billion BTU per year.

The energy conservation opportunities at AAD recommended for implementation are summarized in Table 2 which shows the opportunities costs, savings and the resulting economic indices. A listing of those energy conservation opportunies not recommended for implementation are presented in Table 3.

The estimated energy savings that would result from implementing all the recommended energy conservation projects is 136 billion Btu per year. This amounts to an energy use reduction of 25%.

This report is one of several that have been prepared on AAD. Increments A & B of the Energy Engineering Analysis Program (EEAP) have been performed by Day and Zimmerman, Inc. in 1982. In 1984, SAIC completed Increment F. Currently, SAIC is also performing an EMCS study of AAD.

In this study, two classes of EMCS were considered. One system contained a complete monitoring subsystem and the other (less expensive) system deleted all monitoring functions.

In each case, the discounted savings ratio (SIR) was less than 1, and the projects thus seem unsuitable at this time. Some of the factors which lead to the poor SIR value were:

- Relatively low percentage of total base energy consumption is used for environmental space conditioning;
- The lack of controllable, large air-conditioning loads; and
- Relatively low energy prices ($/unit).

The process (East) area contains approximately 1.4 million square feet of building area and this study is limited to 15 specific buildings in the East Area.

Figures 3, 4, 5, and 6 show a vicinity map, the West/East areas, the East Area and the Coosa Annex.

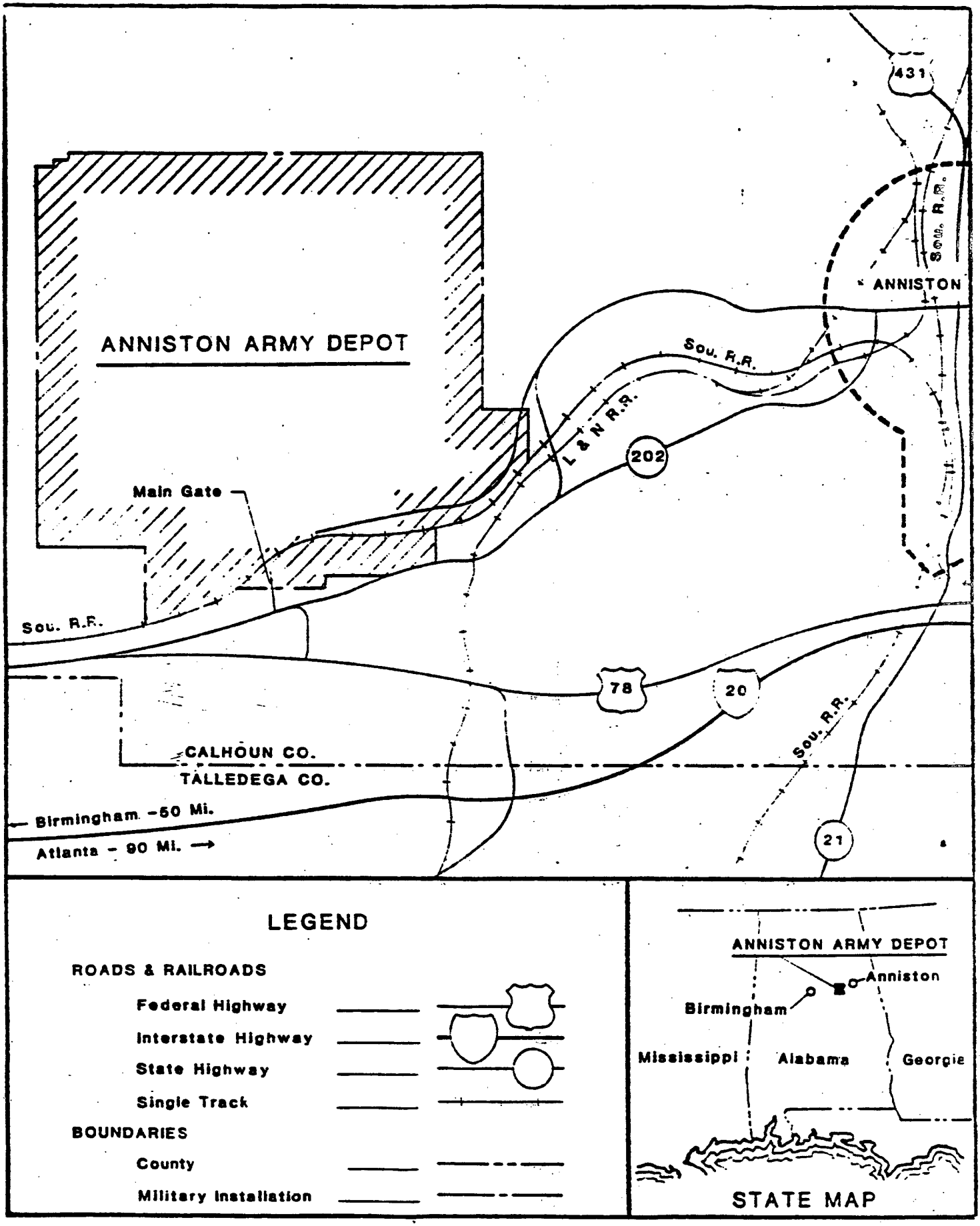


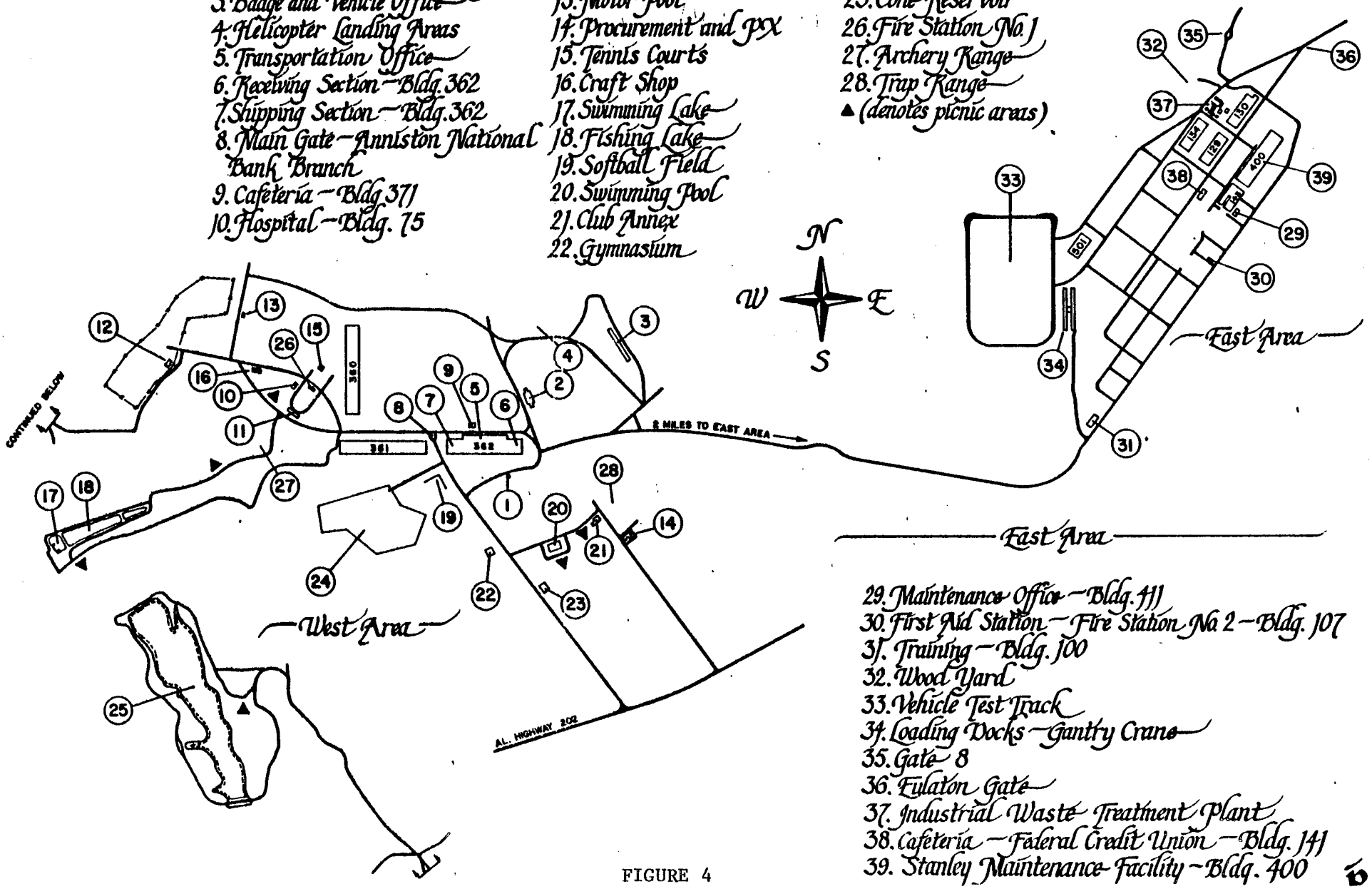
FIGURE 3 : VICINITY MAP - ANNISTON ARMY DEPOT

Anniston Army Depot

West Area

1. Main Visitors' Gate
2. Headquarters - Abrams Bldg. 7
3. Badge and Vehicle Office
4. Helicopter Landing Areas
5. Transportation Office
6. Receiving Section - Bldg. 362
7. Shipping Section - Bldg. 362
8. Main Gate - Anniston National Bank Branch
9. Cafeteria - Bldg. 371
10. Hospital - Bldg. 75
11. Community Club
12. Property Disposal Office
13. Motor Pool
14. Procurement and PX
15. Tennis Courts
16. Craft Shop
17. Swimming Lake
18. Fishing Lake
19. Softball Field
20. Swimming Pool
21. Club Annex
22. Gymnasium
23. A.O.D. Federal Credit Union
24. Terrace Homes
25. Cone Reservoir
26. Fire Station No. 1
27. Archery Range
28. Trap Range

▲ (denotes picnic areas)



East Area

29. Maintenance Office - Bldg. 411
30. First Aid Station - Fire Station No. 2 - Bldg. 107
31. Training - Bldg. 100
32. Wood Yard
33. Vehicle Test Track
34. Loading Docks - Gantry Crane
35. Gate 8
36. Eulaton Gate
37. Industrial Waste Treatment Plant
38. Cafeteria - Federal Credit Union - Bldg. 141
39. Stanley Maintenance Facility - Bldg. 400

FIGURE 4

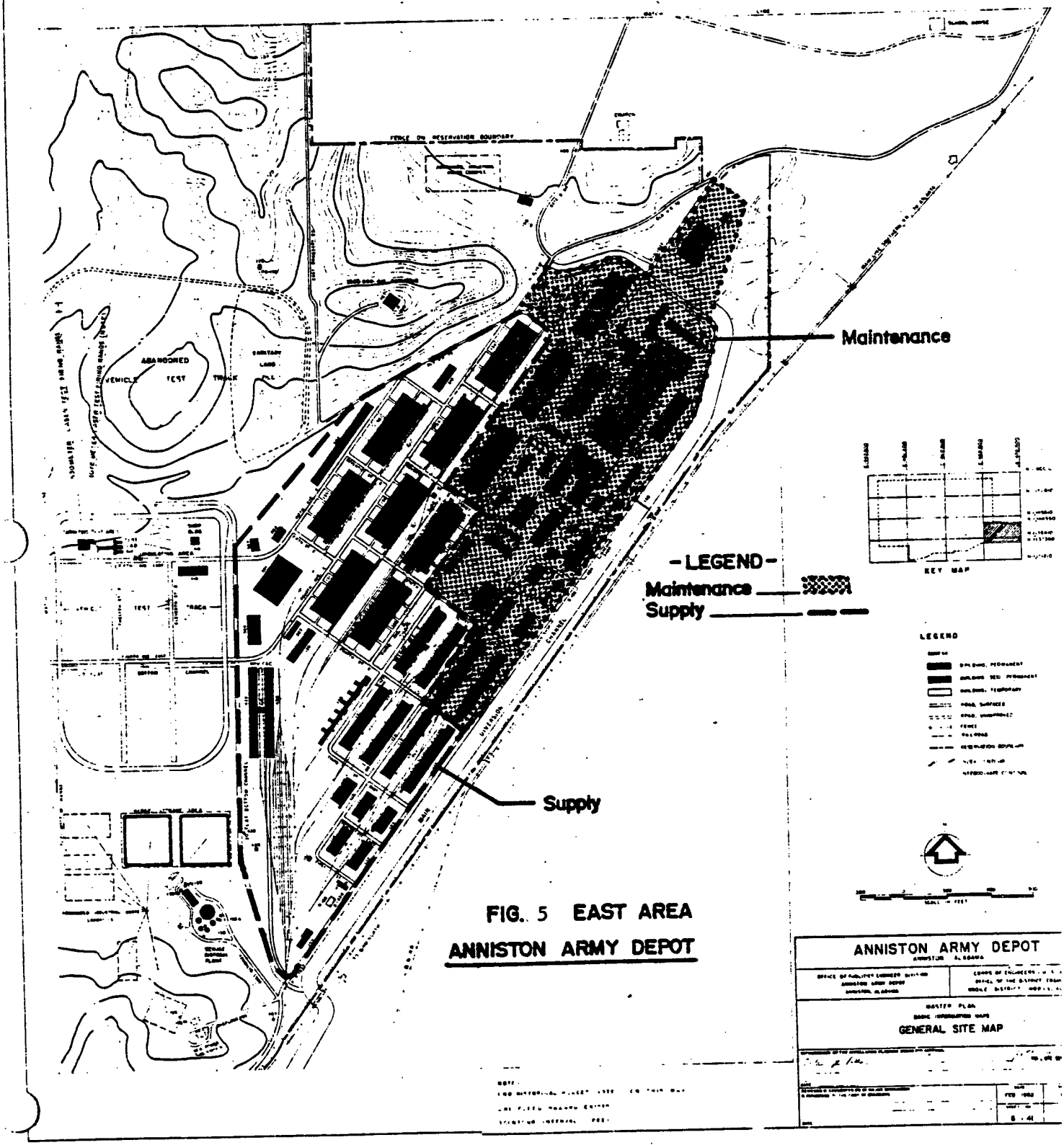


FIG. 5 EAST AREA
ANNISTON ARMY DEPOT

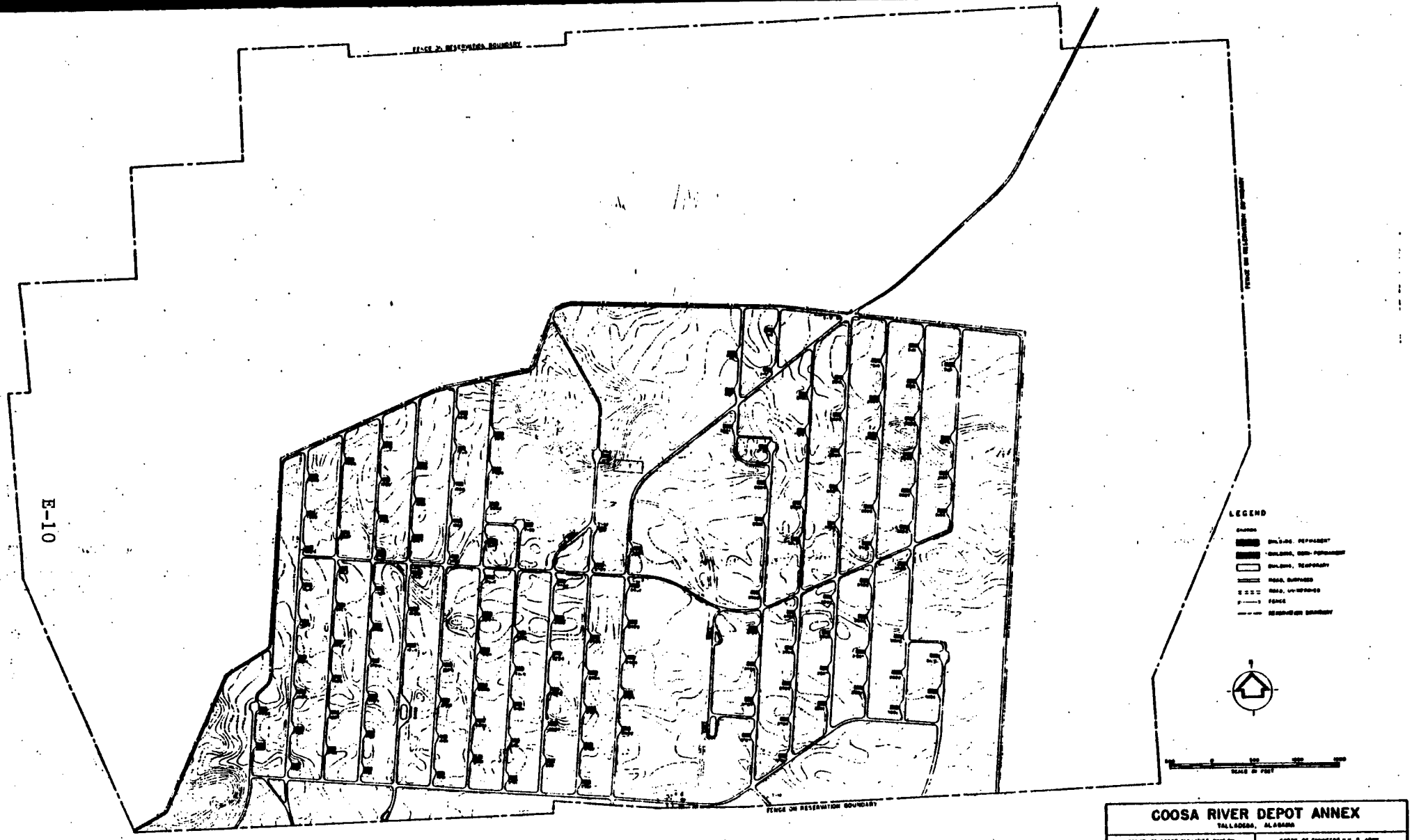


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FIG. 6 COOSA ANNEX – ANNISTON ARMY DEPOT

Only Ammunition Operations Are Located At Coosa Annex.

TABLE 2
ANNISTON ARMY DEPOT ECO STATUS REPORT
ECO'S RECOMMENDED FOR IMPLEMENTATION

Energy Conservation Opportunity	Project Description	Construction Cost	Annual Energy Savings (MBTU)	Annual Cost Savings	Payback (Years)	SIR
IMPROVED CHROME PLATING	Chrome plating piping renovation to allow for closer anode/cathode spacing and reduced plating time.	7016	14396	30595	0.22	44.52
STEAM TRAPS/REPAIR LINES	In the industrial area, repair leaks and bad traps located in the steam and condensate lines.	30825	45626	85020	0.35	21.30
VAT LIDS - REDUCE VENT IN 114	Install moveable lids on plating and cleaning vats in Building 114. This will allow a reduction in the ventilation air entering the buildings.	163053	31725	121836	1.34	8.79
STEAM CONDENSATE RETURN	Return condensate from plating and cleaning tanks or vats located in Buildings 114 and 409.					
STEAM ORIFACE TRAPS	Install oriface type steam traps on the steam mains to allow condensed water to be drained from these lines.	23685	5080	10293	2.3	4.50
ENERGY EFFICIENT MOTORS	It is cost effective to replace electric with energy efficient types when the motors need to be removed for maintenance or replaced.	93395	7987	37866	2.47	3.66
AIR DISTRIBUTION MAINTENANCE	This project is to increase the amount of maintenance given to the compressed air distribution system. An annual maintenance program of over $10,000 is feasible.	20328	1972	5949	3.41	2.06

TABLE 2 CONT.

Energy Conservation Opportunity	Project Description	Construction Cost	Annual Energy Savings (MBTU)	Annual Cost Savings	Payback (Years)	SIR
VARIABLE FREQUENCY DRIVES	Variable frequency drives can reduce the power input to a motor at part load conditions.	49289	1956	9273	5.3	1.74
AUTO CONTROL OF CHEMICAL VATS	Add controls to turn on and to better schedule the operation of the heated cleaning vats.	95742	6705	12873	7.40	1.41
REPLACE MERCURY VAPOR WITH HPS	Replace existing mercury vapor lights in Buildings 108 and 433 to high pressure sodium.	153381	5079	22766	6.70	1.35
POWER FACTOR IMPROVEMENTS	Use capacitors installed on each motor greater than 3 horsepower to improve the power factor at AAD (KVA Saving, non-energy).	215057	0	31082	6.90	1.31
OXYGEN TRIM CONTROLS	Install oxygen trim controls on the boilers located in Building 401 to help reduce the amount of excess air used.	92459	6520	11941	7.7	1.36
MAINTAIN DISTRIBUTION SYSTEM	Annual maintenance program of 100 manhours or $2,000 can be justified. Economics included in "steam trap/repair line" analysis.	0	0	0	0.00	1.00
*** TOTAL ***		944230	127046	379494		

TABLE 3
ANNISTON ARMY DEPOT ECO STATUS REPORT
ECO'S NOT RECOMMENDED

Energy Conservation Opportunity	Project Description	Construction Cost	Annual Energy Savings (MBTU)	Annual Cost Savings	Payback (Years)	SIR
TURBINE EXHAUST	Install a heat recovery unit in each turbine exhaust to obtain heat for heating water in the vats located in Building 409.	244644	8466	13600	18	0.84
REDUCE LIGHT LEVELS	The majority of buildings surveyed had lighting levels within IES recommended values. Buildings with significant daylight can use automatic light dimmers to save energy. The high investment cost makes this option unattractive.	48220	698	3309	14.6	0.71
PAINT DRYING OVENS	The hot gases exhausted from paint drying ovens contain paint particles and fumes which can clog a heat exchanger. The probable cost of filter maintenance is greater than the energy savings.	41595	1963	2569	16.2	0.69
PHOTOCELL EXHAUST FANS	Photoelectric switches that would sense welding smoke could be used to control exhaust fans. Unless existing HOA* switches can be utilized, this option is too costly.	2017	30	144	14.00	0.61
AUTOMATIC DOOR OPENERS	Sensors buried in front of major truck doors sense an entering or leaving truck. The sensor will open and close the door automatically. As a result, doors that are open most of the time can be closed.	29837	868	1507	20	0.57

*HOA = Hand Off Automatic

TABLE 3 CONT.

Energy Conservation Opportunity	Project Description	Construction Cost	Annual Energy Savings (MBTU)	Annual Cost Savings	Payback (Years)	SIR
SOLAR APPLICATIONS	The cost savings are not great enough to cover the costs of the solar system. The payback period is more than 30 years.	45	1	1	32.40	0.30
INSULATED OVERHEAD DOORS	Install insulated doors with an "R" value of 6.25 to reduce heat loss. The low cost of fuel makes this unattractive.	1343	6.5	12	108	0.10
DYNAMOMETER COOLING WATER	Recover heat from the dynamometer cooling water via the use of a heat pump. The electrical energy cost is greater than the coal energy cost.	2142000	18255	-9584	0.00	0.05
FACILITY LAYOUT	No changes are apparent that would result in a dramatic energy use reduction.	0	0	0	0.00	0.00
STEAM VAT EXHAUST	Not enough heat in the exhaust air stream to be cost effective.	0	0	0	0.00	0.00
RETURN SAND-BLASTED AIR	The returning of air from the sand-blasting operation is not recommended since this air is contaminated with particles that are hazardous to breathe.	0	0	0	0.00	0.00
PRODUCTION EQUIPMENT MAINTENANCE	Appeared well taken care of. No improvements were identified that would result in a significant energy use reduction.	0	0	0	0.00	0.00
BOILER ECONOMIZERS	Boiler economizers cannot be considered as an option due to the installation of the baghouse with an air-to-air heat exchanger and the turbine driven equipment that maintains the D/A tank at 225°F.	0	0	0	0.00	0.00

TABLE 3 CONT.

Energy Conservation Opportunity	Project Description	Construction Cost	Annual Energy Savings (MBTU)	Annual Cost Savings	Payback (Years)	SIR
STEAM CLEANING	Use different carbon remover additive in the steam cleaning to reduce cleaning time.	0	0	0	0.00	0.00
RADIANT HEATERS	The energy cost of natural gas is four times the cost of coal. No buildings were found to have a small enough number of work stations to make spot heating effective. Also, the buildings receive a minimum amount of heat.	0	0	0	0.00	0.00
BLOWDOWN/TURBINE RETROFIT	Low pressure steam exhausted from steam-driven fans and pumps is used to heat boiler makeup water. The continuous blowdown is sent to drain. Changing the drives of this equipment to electric motors nd recovering heat from the blowdown is not cost effective because of high electrical costs.	0	-1102	-10754	0.00	0.00
OPTIMIZE AIR COMPRESSORS	The air compressors could be automatically start/stopped based on supply air pressure. This adds little savings over full time operators and is not recommended.	0	0	0	0.00	0.00
AIR COMPRESSOR HEAT RECOVERY	Recover heat from the air compressor cooling water. The low temperature of the water requires a heat pump to bring it to a usable.	0	0	0	0.00	0.00
STRIP DOORS	Install strip doors at major truck doors which are open most of the time to reduce the amount of cold outside air entering the building. The project is evaluated on a unitary basis. The estimated maintenance is greater than any energy saving.	0 2815	0 71	0 -146	0.00 0.00	0.00 -0.40

TABLE 3 CONT.

Energy Conservation Opportunity	Project Description	Construction Cost	Annual Energy Savings (MBTU)	Annual Cost Savings	Payback (Years)	SIR
INDIVIDUAL BOILERS	Evaluated the use of local boilers adjacent to process steam loads instead of using the local coal-fired boiler plant. Since the cost of oil is more than three times the cost of coal, the project does not provide any energy cost saving.	665500	58600	-113932	0.00	-4.60
*** TOTAL ***		3178016	87857	-113274		